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P-T-X evolution of the fluids associated with Li-Sn mineralization from Pedra Alta mine (Argemela, Portugal)

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Aiming the characterisation of mineral phases forming the mineralised Li-Sn quartz lodes at Pedra Alta (Permit Nº1, Argemela) and of the fluids involved in the mineralising processes, a detailed petrography and mineralogy of the lodes were performed together with the study of fluid inclusions (FIs) in amblygonite, quartz, and cassiterite.

Pedra Alta is located in the Central Iberian Zone within the important Góis-Panasqueira-Argemela-Segura mineralization alignment. Is located 9 km west of the Fundão pluton within the metasediments of the Beiras Group. Tin mineralization occurs in subvertical quartz veins striking N80ºE.

The studied samples are characterized by massive amblygonite, in well-developed crystals, associated with anhedral to subhedral quartz grains, displaying textured comb arrangements and mosaic aggregates. After the deposition of amblygonite and quartz, cassiterite occurs, in anhedral to euhedral grains generally zoned and include tiny phases of columbo-tantalite. The main sulphide is stannite and predates chalcopyrite. Native bismuth along with bismuthinite and silver-containing sulfosalts occur filling cracks in cassiterite. Their formation must have occurred after the development of Sn-bearing phases, as they also occur enclosed in stannite.

The petrographic examination revealed the presence of primary FIs in amblygonite, quartz and cassiterite. The study of these inclusions show that water is the main component of FIs trapped in different mineral phases. The CO_2, CH_4, N_2 and salt components are always minor. Nonetheless, fluids with a CO_2-dominant volatile phase were trapped in amblygonite and quartz, whereas fluids trapped in cassiterite show variations from CO_2- to CH_4-dominant volatile phase. FIs global homogenization temperatures range from: 280 °C to 315 °C for fluids in amblygonite; 310 °C to 360 °C for fluids in quartz; and 240 °C to 330 °C for fluids in cassiterite, suggesting trapping conditions at pressures higher than 50 MPa. The results indicate a temperature decrease from amblygonite to cassiterite crystallization, along with a change in fluid composition, conceivably due to changes in redox conditions and increase of rock/fluid interaction.

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